Hos 3-14

AQUATIC INSECT ANALYSIS
FOR THE 1975
SPRUCE BUDWORM PROJECT

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Introduction

The number of drifting organisms passing a given point in a stream is subject to several sources of variation, such as: time of day, amount of light and heat, water velocity, bank cover, stream nutrient levels, disturbance, and life-history stage of the insects (Hynes 1970). Therefore, it is difficult to isolate a disturbance, in the form of insecticides as the single cause of increased drift. Experimental controls which were imposed during the 1975 spray project included matching pre- and post-spray samples with respect to time of day, sampling locations, and length of sampling period. Variables which were not, or could not be, controlled included: emergences and other growth changes, light and heat differences, fluctuations in water velocity due to evaporation or rain, and amount of backwash out of nets due to clogging of mesh.

Assuming the above variations were minor, there remain several factors yet to be considered in estimating the efforts of the insecticides upon aquatic fauna. Before the relative toxicities of Sevin and Dylox can be assessed, the concentration of spray entering the streams should be known. Unless one insecticide were much more toxic, the spray hitting a stream more directly would be expected to cause the greater disturbance. And does this disturbance result in the death of the aquatic insects? Hynes (1970) agrees in part by proposing, "Presumably, under normal circumstances, drifting invertebrates either find an empty niche in which to settle, or they are eaten by such predators as fish or net-spinning caddisworms. Great numbers must, however, be swept out of areas which are habitually suitable for them and must ultimately perish."

Kick samples were collected before and after spray application to help assess the lethality of the disturbance. Variables such as size of bottom area sampled and velocity of surrounding water are inherent in kick samples, precluding their use in quantitative comparisons. However, the persistance of insecticide caused damages can be demonstrated qualitatively by drastic changes in size and/or diversity of post-spray samples. If little change is observed, one might suspect that either the insecticide was not very toxic or that recruitment from upstream and/or downstream sources was sufficient to mask the temporary disturbance.

Methods and Materials (Laboratory)

Drift and kick samples, initially preserved in 10% formalin, were emptied into a #40 sieve and washed with water to remove the formalin and finer particulate matter. The sieve contents were transferred to 70% alcohol. Aquatic insects were separated from detritus using a standard binocular microscope at 7x magnification. Insects were keyed most often to genus, except dipterans, which were identified to family. Volumes of drift samples were estimated by water displacement and presented in histograms. Rankings were given only to taxa represented by at least five organisms in a given drift sample.

Results - Block 2 (Sevin)

Daisy Creek - The volume of drifting organisms increased very slightly over pre-spray levels during the application of Sevin. Most of the increase could be attributed to an influx of springtails (Collembola) which are semi-aquatic, inhabiting the shoreline areas. Otherwise, pre-spray and spray drift samples were taxonomically similar.

Analysis of the kick samples revealed that spray impact was short-lived. The few genera found only in pre-spray samples were present in such small quantities that sampling variation could explain their disappearance. In fact, the total number of aquatic insects collected increased in post-spray samples.

South Fork Meadow Creek, Stations B-1 and B-2 - During spraying, drift in the South Fork of Meadow Creek increased to seven times the pre-spray levels at Station B-1. A change in the principal drifting organisms was also noted. Before spraying, members of Chironomidae, Baetis, and Alloperla contributed most to the drift. Simuliidae, Siphlonurus, and Cinygmula, minor constituents before, predominated during spraying. Drift increased less at Station B-2 during spraying, but its composition changed noticeably. An influx of Simuliidae, Siphlonurus, and Cinygmula, none of which were found in pre-spray samples, accounted for most of the increase.

Again kick samples showed that spray effects were not lasting. Only Rhithrogena exhibited a steady decline. This may have been due to emergence. Selective sensitivity to Sevin seems an unlikely explanation, because other fragile mayfly genera present either persisted through sampling or appeared in post-spray samples.

Leonard Creek - A very dramatic increase from less than one millilitter per hour (pre-spray) to about 100 millilitters per hour (spray) was noted in Leonard Creek. Many more species were found in the latter sample. Except for Baetis, those insects most abundant in the spray sample were an insignificant part of or absent from the pre-spray drift sample.

This is a stonefly genus!

By July 16, all ~~but one~~ genus of may flies found in pre-spray kick samples, i.e., Peltoperla, were absent. The relative abundance of stoneflies (~~especially~~ Diura) had increased, but this was of little importance since the total number of insects had decreased from 44 to only 9. By October 31, the number and diversity of insects exceeded pre-spray levels, suggesting that Leonard Creek had been recolonized.

Results - Block 8 (Sevin)

Ruby Creek, Station C - Peak drift (30 milliliters per hour) during spraying was substantially higher than pre-spray levels (less than one milliliter). This increase was caused primarily by an influx of many Alloperla and Nemoura. Spray drift had already decreased nearly to pre-spray volume before sampling was completed.

Both volume and diversity of kick samples increased after spraying, suggesting that spray effects were transitory.

Ruby Creek, Station B - From 0800 to 0900 during spray application, drift reached a peak of approximately 200 milliliters, as compared to less than one milliliter during the same time before spraying. The change in drift composition was also dramatic with six taxa appearing in pre-spray drift and 18 taxa in spray drift.

Although the diversity of the kick samples changed little, the total number of organisms in post-spray samples was only half that of pre-spray samples. However, a sample taken on November 14 indicated that most of the pre-spray organisms were still represented within the stream community. Again Sevin appeared to have a noteable but temporary effect.

Ruby Creek, Station A - Drift increase was again very pronounced, jumping from less than one milliliter per hour to a range from 50 milliliters per hour to 150 milliliters per hour. Nine taxa were found in pre-spray drift while 26 taxa comprised the spray drift.

The taxonomic composition of kick samples changed from pre- to post-spray, but total numbers of organisms and total diversity changed little. Selective emergence or variation in sampling sites (e.g., with different water velocities) could explain these minor differences.

Block 6 (Sevin)

Middle Fork Warm Springs Creek, Station A - The volume of drifting insects increased from almost none each hour before spraying to 200 milliliters per hour at peak spray drift. This marked change decreased to only 10 milliliters, five hours after spray effects first appeared.

Relative abundances of organisms was not estimated for pre-spray kick samples. However, observed rankings indicate that several mayfly genera present earlier were absent from post-spray samples. An overall decrease in diversity was counteracted, though, by the appearance of additional stoneflies, caddisflies, and true flies.

Results - Block 4 (Dylox)

Warm Springs Creek - Spray drift was significantly larger than pre-spray drift. The same insect taxa were principle constituents to both the pre-spray and spray samples. The latter sample also contained small numbers of new organisms, many not normally found drifting.

Kick samples were very similar before and after spraying, suggesting that impact was light.

Results - Block 7 (Dylox)

South Fork Warm Springs Creek - Drift of insects during spray application increased very little over pre-spray levels. Perhaps a minor impact was reflected in the addition of several new organisms to the drift.

An increase in diversity of post-spray kick samples indicates that sampling variation was probably more significant than spray effects.

Smith Creek and French Creek - Again, as in the South Fork of Warm Springs Creek, a change in diversity, but not volume, was the only indication of possible spray impact.

No post-spray kick samples were available to confirm the supposition of negligible impact.

Squaw Creek - No drift samples were collected. Only one pre-spray kick sample was collected and analyzed.

Summary

The application of spruce budworm insecticides upon streams resulted in a significant increase in the number of drifting organisms. Impact was greatest in those streams sprayed with Sevin. For example, in Leonard Creek, Ruby Creek, and the Middle Fork of Warm Springs Creek, drift volumes per hour rose from less than one milliliter to peaks of 100 milliliters, 200 milliliters, and 200 milliliters respectively during spraying. Dylox had little effect on any stream except Warm Springs

Daisy Cr. <1 → 2

S. Fork Meadow Cr. B-1 <1 → 7

B-2 <1 → 4

Ruby Cr. C <1 → 30

appears to be an average of Stations A & B. Why was Station C not averaged in here?

where spray drift increased 30 milliliters over pre-spray levels.

Examination of kick samples taken before and after spray application revealed that the fauna in all the streams was capable of recovery. Volume and diversity of post-spray samples was comparable, within experimental error, to pre-spray collections.

HOURLY DRIFT

(Volume in Milliliters)

BLOCK 2

Daisy Creek, Station A

0615	0715	0815	0915	1015	
	< 1	< 1	< 1	1	(pre-spray)
1	2	2	1	3	(spray)

South Fork Meadow Creek, Station B-1

0700	0800	0900	1000	
1	< 1	< 1	< 1	(pre-spray)
1	7	5	4	(spray)

South Fork Meadow Creek, Station B-2

0650	0750	0850	0950	
< 1	< 1	< 1		(pre-spray)
< 1	1	4	< 1	(spray)

Leonard Creek, Station C ← Where are stations A & B?

0710	0810	0910	1010	
< 1	< 1	< 1	1	(pre-spray)
< 1	100	50 (½ hr.)		(spray)

BLOCK 8

Ruby Creek, Station A

0710	0810	0910	1010	1110	
< 1	< 1	< 1	< 1		(pre-spray)
< 1	150	50	100	75	(spray)

Ruby Creek, Station B

0725	0825	0925	1025	1125	
< 1	< 1	< 1	< 1		(pre-spray)
15	50	250	180	50	(spray)

HOURLY DRIFT Cont'd

(Volume in Milliliters)

BLOCK 8

Ruby Creek, Station C

0735	0835	0935	1035	1135	
<1	<1	<1	<1		(pre-spray)
30	30	10	1	2	(spray)

BLOCK 6

Middle Fork Warm Springs Creek, Station A

0655	0755	0855	0955	---	1255	1355	
	<1	0					(pre-spray)
1	<1	100	200		150	10	(spray)

BLOCK 4

Warm Springs Creek

0730	0830	0930	1030	
1	<1	1		(pre-spray)
2	15	25	15	(spray)

BLOCK 7

South Fork Warm Springs Creek

0700	0800	0900	1000	
	1	<1		(pre-spray)
1	2	2	2	(spray)

Smith Creek

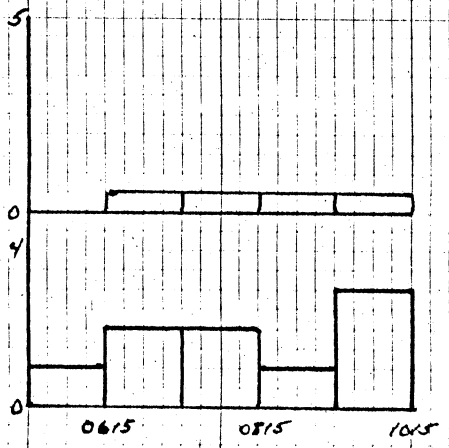
(pre-spray)		(spray)	
0545	0700	0800	0900
<1	<1	<1	<1

French Creek

(pre-spray)		(spray)	
0555	0700	0800	0900
<1	<1	<1	1

BLOCK 2, HOURLY DRIFT SAMPLES BY VOLUME (ml)

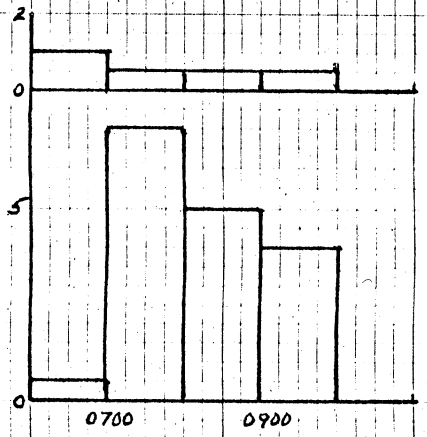
DAISY CREEK, STATION A



PRE-SPRAY

SPRAY

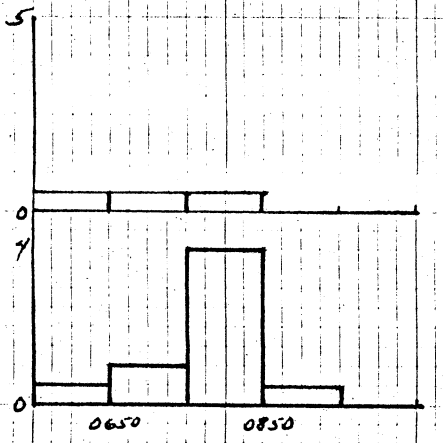
S.F. MEADOW CK., STATION B-1



PRE-SPRAY

SPRAY

S.F. MEADOW CK., STATION B-2

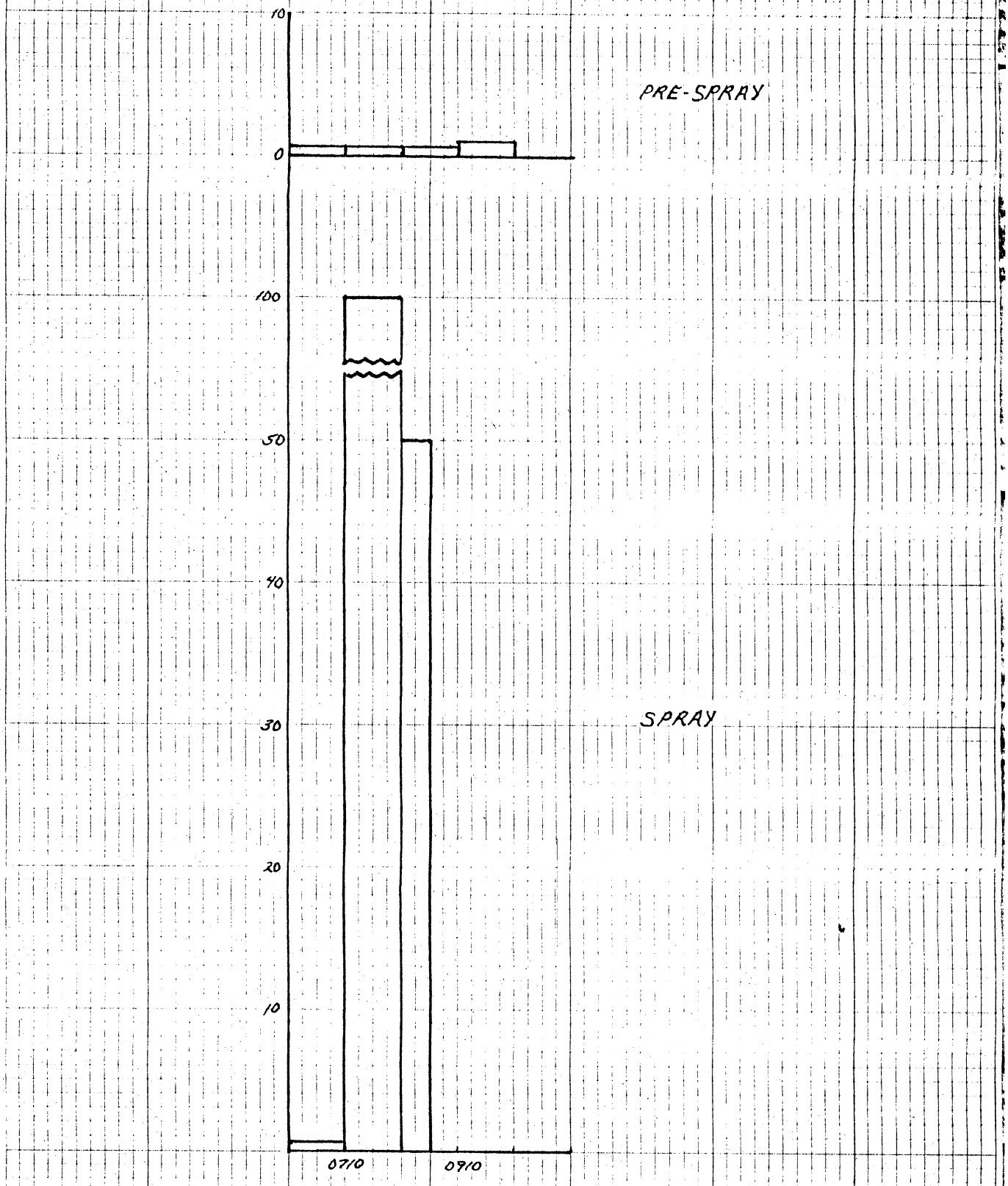


PRE-SPRAY

SPRAY

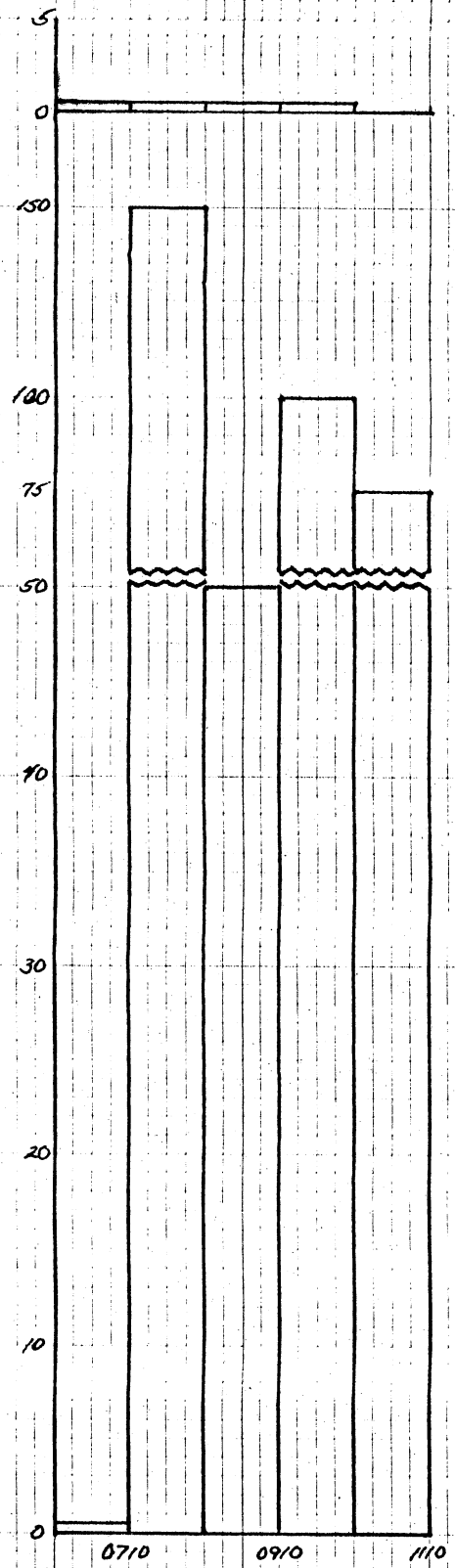
BLOCK 2 (CONT'D)

LEONARD CK., STATION C



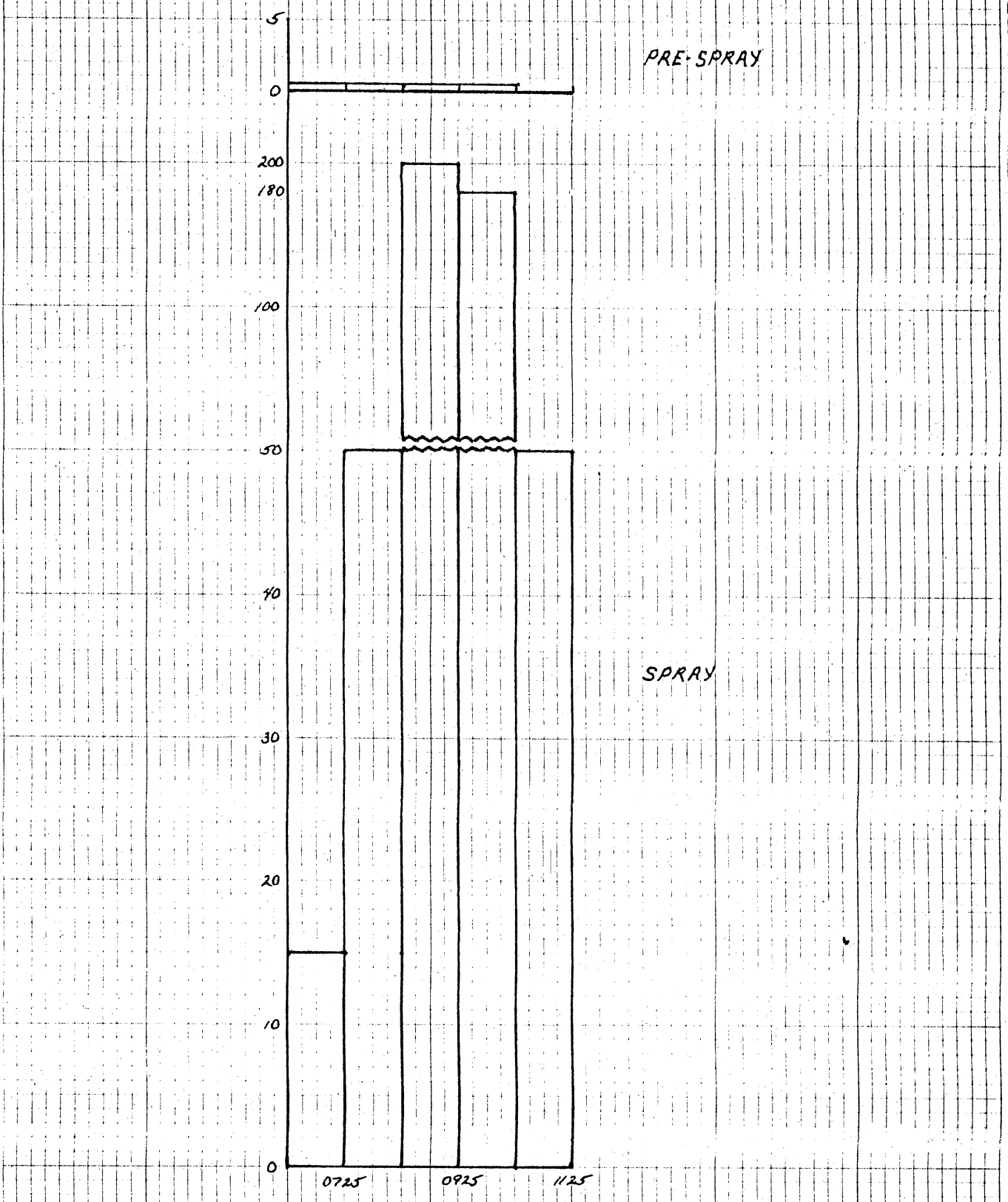
BLOCK 8, HOURLY DRIFT SAMPLES BY VOLUME (ml)

RUBY CREEK, STATION A



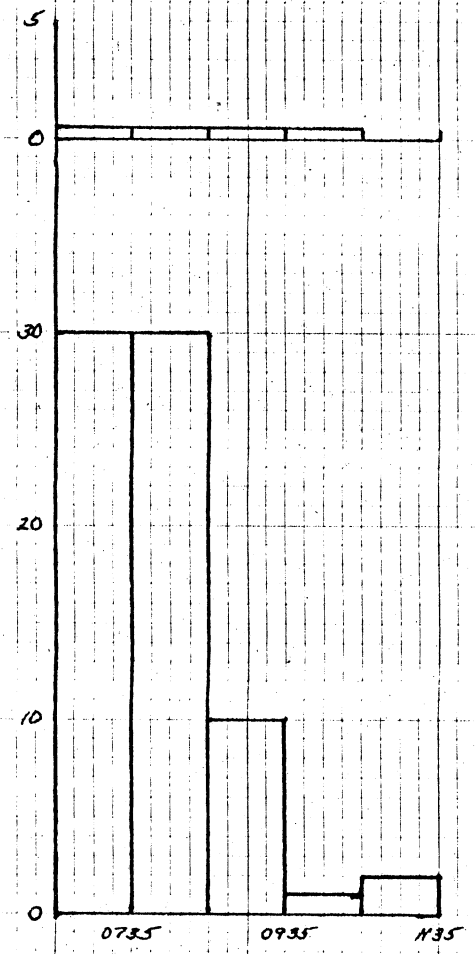
BLOCK 8 (CONT'D.)

RUBY CREEK, STATION B



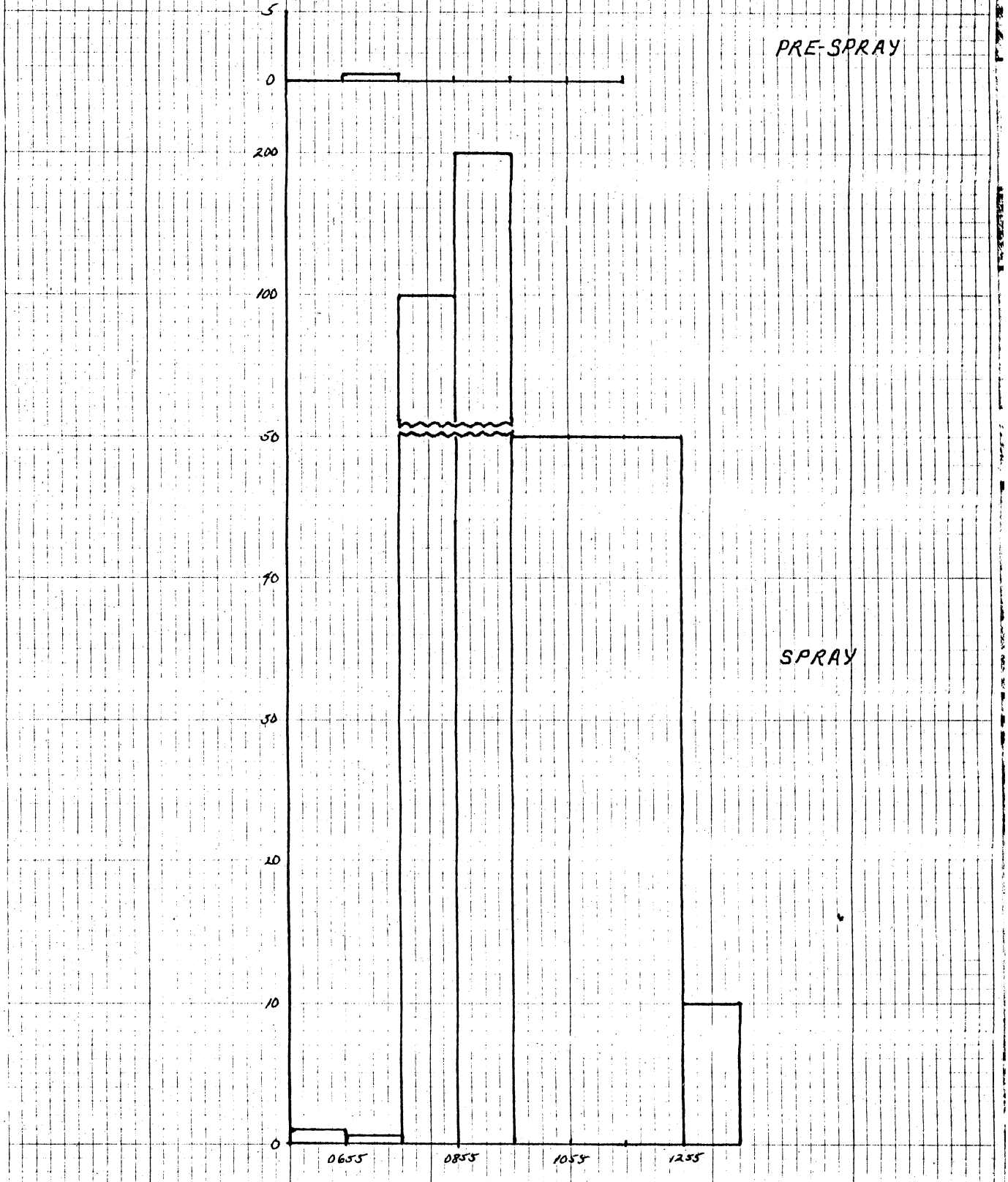
BLOCK 8 (CONT'D)

RUBY CREEK, STATION C



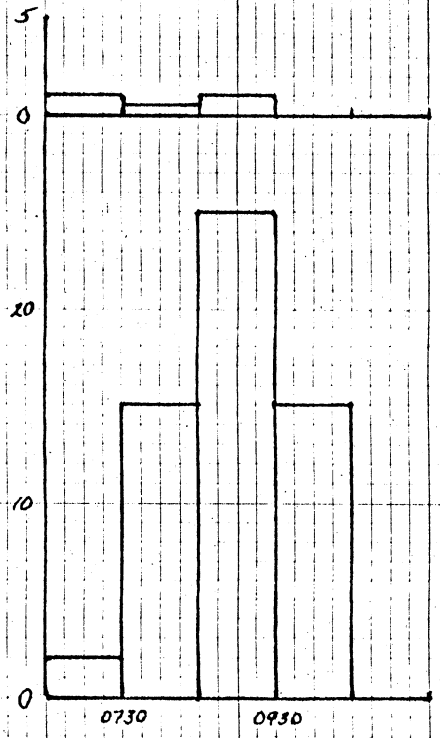
BLOCK 6, HOURLY DRIFT SAMPLES BY VOLUME (ml)

M.F. WM. SPRINGS CREEK, STATION A



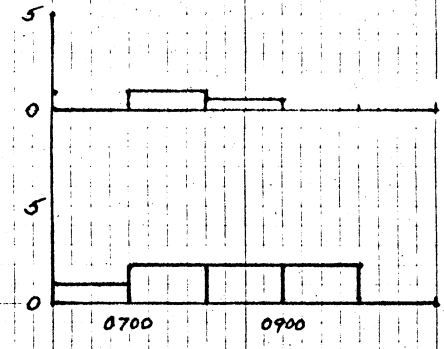
BLOCK 4, HOURLY DRIFT SAMPLES BY VOLUME (ml)

WARM SPRINGS CREEK



BLOCK 7

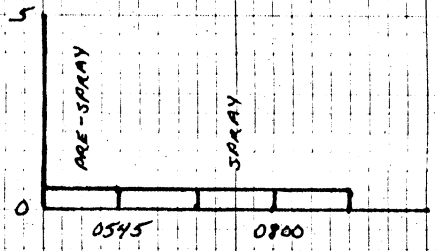
S.F. WARM SPRINGS CREEK



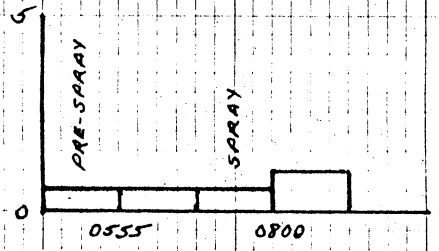
HOURLY DRIFT SAMPLES BY VOLUME (ml)

BLOCK 7 (CONT'D.)

SMITH CREEK



FRENCH CREEK



BLOCK 2, DAISY CREEK, STATION A

Rank	Pre-Spray Drift
1	Lepidostoma
2	Baetis
3	Chironomidae
4	Peltoperla
5	Nemoura
6	Neureclipsis
7	Ephemerella
8	Cinygmula
	Epeorus
	Isoperla
	Chloroperlidae
	Elmidae
	Ephydridae
	Paraleptophlebia
	Simuliidae

Rank	Spray Drift
1	Collembola
2	Lepidostoma
3	Baetis
4	Chironomidae
5	Peltoperla
6	Alloperla
7	Siphlonurus
8	Nemoura
9	Cinygmula
9	Ephemerella
9	Epeorus
9	Elmidae
10	Neureclipsis
10	Diptera (other)
11	Rhithrogena
	Chloroperlidae
	Rhyacophilidae
	Ephydridae
	Paraleptophlebia
	Empididae

(%)	Pre-Kick (7-8)
18	Lepidostoma
13.5	Peltoperla
13.5	Baetis
12	Cinygmula
9	Paraleptophlebia
6	Rhyacophilidae
4.5	Rhithrogena
4.5	Ephemerella
4.5	Acroneuria
3	Epeorus
1	Siphlonurus
3	Nemoura
1	Neureclipsis
1	Limnephilidae
1	Elmidae
3	Chironomidae
	Total 111

(%)	Post-Kick (7-10)
52	Lepidostoma
10	Baetis
7	Peltoperla
5	Epeorus
5	Cinygmula
5	Ephemerella
4	Rhithrogena
2	Siphlonurus
1	Nemoura
1	Alloperla
1.5	Elmidae
3	Rhyacophilidae
1.5	Neureclipsis
1	Parapsyche
1.5	Psychodidae
	Total 135

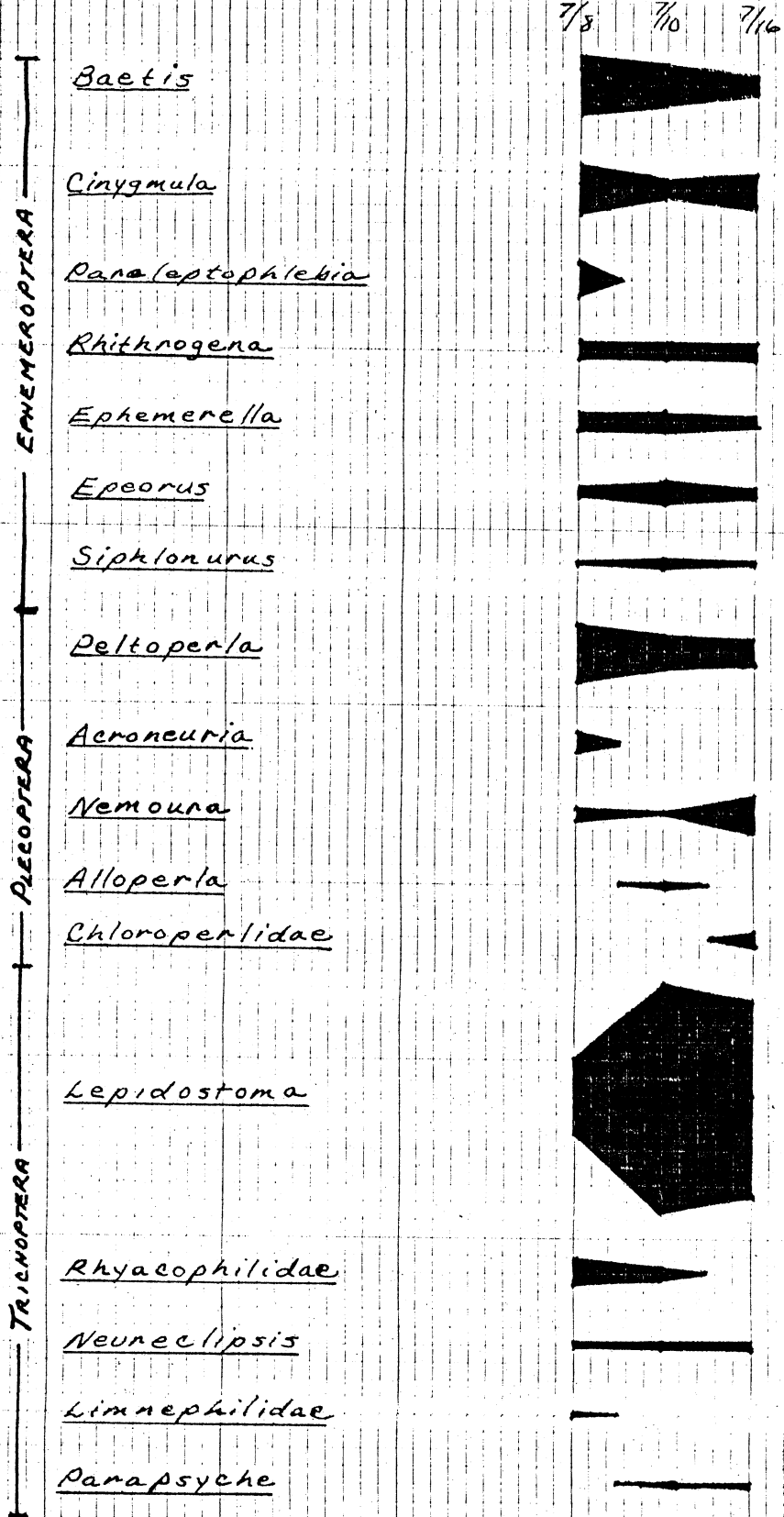
(%)	Post-Kick (7-16)
43.5	Lepidostoma
9	Cinygmula
9	Nemoura
6	Peltoperla
5	Baetis
5	Elmidae
4	Rhithrogena
3	Ephemerella
3	Chloroperlidae
3	Chironomidae
2	Epeorus
1	Siphlonurus
2	Neureclipsis
1	Parapsyche
2	Simuliidae
1	Empididae
	TERREST.
	Total 161

(%)	Post-Kick (10-30)
48.5	Lepidostoma
14.5	Peltoperla
13	Epeorus
5	Nemoura
0.5	Rhithrogena
0.5	Cinygmula
1.5	Baetis
2	Ephemerella
1.5	Paraleptophlebia
2	Acroneuria
1.5	Alloperla
1	Elmidae
2	Parapsyche
2	Neureclipsis
0.5	Rhyacophilidae
2	Psychodidae
2	Chironomidae
0.5	Tipulidae
	Total 206+

DAISY CREEK BLOCK 2

Kick Samples	Relative Abundance (Percent Total Numbers, N)		
	7/8	7/10	7/16
Baetis	13.5	10	5
Cinygmula	12	5	9
Paraleptophlebia	9		
Rhithrogena	4.5	4	4
Ephemerella	4.5	5	3
Epeorus	3	5	2
Siphlonurus	1	2	1
Peltoperla	13.5	7	6
Acroneuria	4.5		
Nemoura	3	1	9
Alloperla		1	
Chloroperlidae			3
Lepidostoma	18	52	43.5
Rhyacophilidae	6	3	
Neureclipsis	1	1.5	2
Limnephilidae	1		
Parapsyche		1	1
Elmidae	1	1.5	5
Chironomidae	3		3
Psychodidae		1.5	
Simuliidae			2
Empididae			1
N	111	135	161

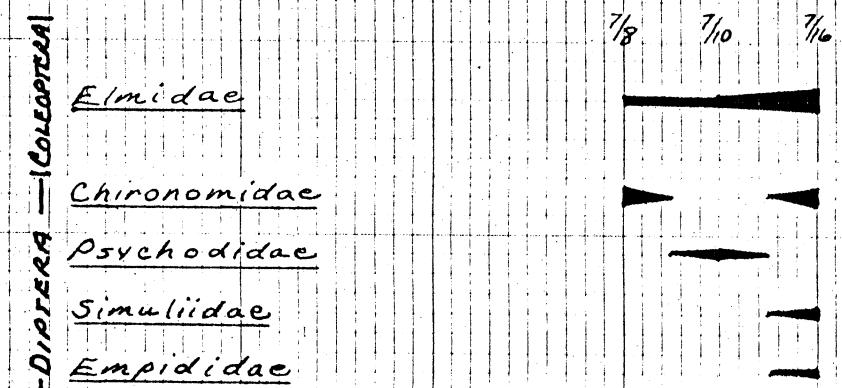
DAISY CREEK
KICK SAMPLES
RELATIVE ABUNDANCES



DAISY CREEK (CONT'D)

COLEOPTERA

DIPTERA



BLOCK 2, SOUTH FORK MEADOW CREEK, STATION B-1

Rank	Pre-Spray Drift
1	Chironomidae
2	Baetis
3	Alloperla
	Ephemerella
	Cinygmula
	Epeorus
	Lepidostoma
	Parapsyche
	Diptera (other)
	Siphlonurus
	Nemoura
	Neureclipsis
	Collembola
	Tipulidae
	Nematoda
	TERREST.

Rank	Spray Drift
1	Simuliidae
2	Siphlonurus
3	Cinygmula
4	Chironomidae
5	Baetis
6	Alloperla
7	Epeorus
8	Nemoura
9	Diptera (other)
10	Rhithrogena
11	Paraleptophlebia
12	Neureclipsis
	Blephariceridae
	Ephemerella
	Dixidae
	Arcynopteryx
	Parapsyche
	Tipulidae
	Rhyacophilidae
	TERREST.

(%)	Pre-Kick $\binom{B-1}{B-2}$ (7-8)
50	Rhithrogena
12.5	Cinygmula
12.5	Baetis
6	Nemoura
6	Chironomidae
6	Diptera (other)
6	Trichoptera
	Total 16

(%)	Post-Kick (7-10) $\binom{B-1}{B-2}$
27	Cinygmula
23	Baetis
23	Rhithrogena
7	Epeorus
3	Paraleptophlebia
3	Ephemerella
3	Acroneuria
3	Nemoura
3	Neureclipsis
3	Psychodidae
	Total 30

(%)	Post-Kick (7-16) $\binom{B-1}{B-2}$
20	Epeorus
15	Cinygmula
15	Acroneuria
15	Baetis
10	Alloperla
7	Chironomidae
7	Ephemerella
5	Neureclipsis
2	Rhithrogena
1	Arcynopteryx
3	Parapsyche
2	Psychodidae
	Total 102

(%)	Post-Kick (10-30) $\binom{B-1}{B-2}$
38	Nemoura
19	Arcynopteryx
14	Epeorus
8	Rhithrogena
6	Neureclipsis
5	Parapsyche
2	Ephemerella
1	Baetis
0.5	Alloperla
0.5	Elmidae
2	Rhyacophilidae
0.5	Trichoptera case
2	Chironomidae
0.5	Tipulidae
	Total 209

BLOCK 2, SOUTH FORK MEADOW CREEK, STATION B-2

No Rank	Pre-Spray Drift	Rank	Spray Drift
All	Baetis	1	Simuliidae
<5	Epeorus	2	Siphlonurus
	Arcynopteryx	3	Cinygmula
	Chironomidae	4	Baetis
	Diptera (other)	4	Epeorus
	TERREST.	5	Chironomidae
		6	Nemoura
			Paraleptophlebia
			Rhithrogena
			Trichoptera cases
			Tipulidae
			Ephemerella
			Alloperla
			Psychomiidae
			Diptera (other)

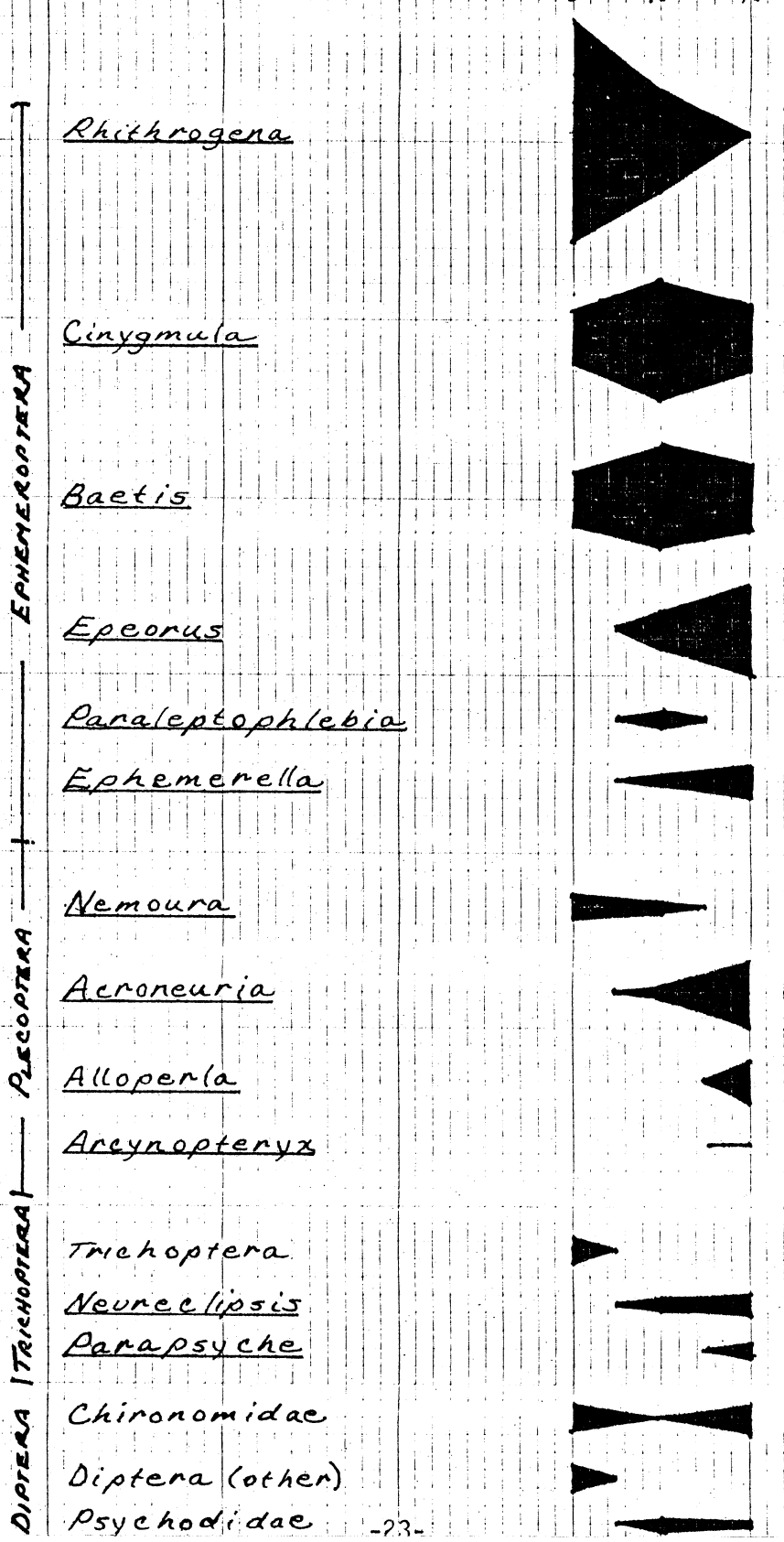
Pre-Kick and Post-Kick rankings listed under:

Block 2, South Fork Meadow Creek, Station B-1

SOUTH FORK MEADOW CREEK — BLOCK 2

Kick Samples	Relative Abundance (Percent Total Numbers, N)		
	7/8	7/10	7/16
Rhithrogena	50	23	2
Cinygmula	12.5	27	15
Baetis	12.5	23	15
Epeorus		7	20
Paraleptophlebia		3	
Ephemerella		3	7
Nemoura	6	3	
Acroneuria		3	15
Alloperla			10
Arcynopteryx			1
Trichoptera	6		
Neureclipsis		3	5
Parapsyche			3
Chironomidae	6		7
Diptera (other)	6		
Psychodidae		3	2
N	16	30	102

S.F. Meadow Creek
Kick Samples
Relative Abundances



BLOCK 2, LEONARD CREEK, STATION C

Rank	Pre-Spray Drift
1	Collembola
2	Chironomidae
3	Baetis
4	Nemoura
	Ephemerella
	Plecoptera(early instar)
	Diptera (other)
	Peltoperla
	Neureclipsis
	Siphlonurus
	Chloroperlidae
	Cinygmula
	TERREST.

Rank	Spray Drift
1	Baetis
2	Alloperla
3	Isogenus
4	Cinygmula
5	Simuliidae
6	Peltoperla
7	Blephariceridae
8	Siphlonurus
9	Rhyacophilidae
	Paraleptophlebia
	Psychomiidae
	Limnephilidae
	Dixidae
	Epeorus
	Arcynopteryx
	Trichoptera (other)
	Chironomidae
	Neureclipsis
	Nemouridae
	Collembola
	Rhithrogena
	TERREST.

(%)	Pre-Kick (7-8)
23	Cinygmula
23	Baetis
16	Peltoperla
11	Diura
11	Chironomidae
2	Epeorus
2	Ephemerella
2	Alloperla
4.5	Neureclipsis
2	Trichoptera (other)
2	Blephariceridae
2	Empididae
	Total 44

(%)	Post-Kick (7-10)
25	Cinygmula
17	Baetis
8	Peltoperla
8	Alloperla
17	Limnephilidae
8	Neureclipsis
8	Donacia
8	Chironomidae
	TERREST.
	Total 12

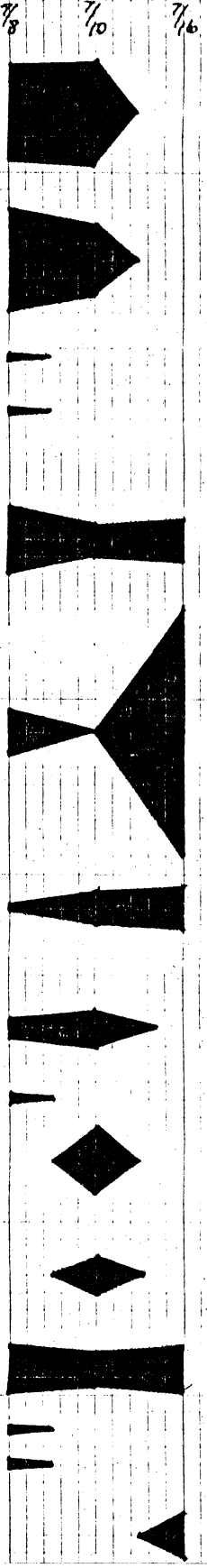
(%)	Post-Kick (7-16)
56	Diura
11	Alloperla
11	Peltoperla
11	Chironomidae
11	Nematoda
	TERREST.
	Total 9

(%)	Post-Kick (10-31)
28	Baetis
20	Peltoperla
17	Arcynepteryx
14	Nemoura
4	Neureclipsis
4	Ephemerella
3	Alloperla
0.5	Epeorus
2	Rhithrogena
0.5	Paraleptophlebia
2	Paraperla
2	Lepidostoma
1	Glossosomatidae
1	Elmidae
2	Simuliidae

LEONARD CREEK BLOCK 2

Kick Samples	Relative Abundance (Percent Total Numbers, N)		
	7/8	7/10	7/16
Cinygmula	23	25	
Baetis	23	17	
Epeorus	2		
Ephemerella	2		
Peltoperla	16	8	11
Diura	11		56
Alloperla	2	8	11
Neureclipsis	4.5	8	
Trichoptera (other)	2		
Limnephilidae		17	
Donacia		8	
Chironomidae	11	8	11
Blephariceridae	2		
Empididae	2		
Nematoda			11
N	44	12	9

LEONARD CREEK
KICK SAMPLES
RELATIVE ABUNDANCES



EPHEMEROPTERA

PLECOPTERA

TRICHOPTERA

COLEOPTERA

DIPTERA

Cinygmula

Baetis

Epeorus

Ephemerella

Peltoperla

Diura

Alloperla

Neureclipsis

Trichoptera (other)

Limnephilidae

Donacia

Chironomidae

Blephariceridae

Empididae

Nematoda

BLOCK 8, RUBY CREEK, STATION A

Rank	Pre-Spray Drift
1	Baetis
2	Chironomidae
	Epeorus
	Cinygmula
	Chloroperlidae
	Tipulidae
	Trichoptera (cases)
	Ephemerella
	Perlodidae
	Mollusca
	TERREST.

Rank	Spray Drift
1	Baetis
2	Alloperla
3	Chironomidae
4	Rhithrogena
5	Cinygmula
5	Simuliidae
6	Epeorus
7	Diura
8	Tipulidae
9	Siphlonurus
	Chloroperlidae
	Psychomiidae
	Lepidostoma
	Rhyachophilidae
	Heleidae
	Diptera (other)
	Ephemerella
	Isogenus
	Isoperla
	Peltoperla
	Limnephilidae
	Paraleptophlebia
	Neureclipsis
	Dytiscidae
	Brachyptera
	Pteronarcys
	TERREST.

(%)	Pre-Kick (7-9)
29	Neureclipsis
23.5	Epeorus
23.5	Rhithrogena
8	Ephemerella
2	Isoperla
2	Acroneuria
2	Diura
8	Alloperla
2	Chironomidae
	Total 51

Rank	Hand-Picked (7-9)
1	Neureclipsis
2	Ephemerella
3	Hydropsyche
4	Epeorus
5	Rhithrogena

(%)	Post-Kick (7-15)
22	Cinygmula
14.5	Alloperla
14.5	Neureclipsis
12	Ephemerella
7	Limnephilidae
7	Epeorus
7	Diura
7	Baetis
1	Lepidostoma
1	Elmidae
3	Tipulidae
1	Chironomidae
	Total 69

Rank	Post-Kick (11-14)
1	Nemoura
2	Neureclipsis
3	Psychodidae
3	Chironomidae
4	Cinygmula
4	Rhithrogena
5	Baetis
6	Parapsyche
7	Arcynopteryx
	Ephemerella
	Acroneuria
	Isoperla
	Limnephilidae
	Trichoptera cases
	Glossosomatidae

Rank	Post-Kick (A above, 11-14)
1	Isoperla
2	Acroneuria
3	Chironomidae
4	Neureclipsis
5	Nemoura
6	Cinygmula
7	Baetis
	Ephemerella
	Arctopsyche
	Glossosomatidae
	Trichoptera cases
	Tipulidae
	Psychodidae

BLOCK 8, RUBY CREEK, STATION B

Rank	Pre-Spray Drift
1	Baetis
2	Lepidostoma
	Cinygmula
	Chironomidae
	Ephemerella
	Diptera (other)
	TERREST.

Rank	Spray Drift
1	Baetis
2	Alloperla
3	Cinygmula
4	Simuliidae
5	Ameletus
6	Rhithrogena
7	Ephemerella
8	Isoperla
9	Nemoura
10	Diura
	Peltoperla
	Psychodidae
	Glossosomatidae
	Lepidostoma
	Amphizoa
	Tipulidae
	Epeorus
	Nematoda
	TERREST.

(%)	Pre-Kick (7-9)
30	Ephemerella
20	Baetis
20	Rhithrogena
8	Neureclipsis
7	Glossosomatidae
3	Epeorus
3	Alloperla
1	Arcynopteryx
2	Diura
1	Peltoperla
1	Limnephilidae
3	Chironomidae
1	Simuliidae
	Total 300

(%)	Post-Kick (7-15)
31	Ephemerella
14	Baetis
14	Glossosomatidae
10.5	Neureclipsis
7	Limnephilidae
7	Alloperla
3.5	Chironomidae
1	Cinygmula
1	Peltoperla
1	Nemouridae
3	Hydropsychidae
3	Elmidae
3	Diptera (other)
	TERREST.
	Total 143

Rank	Post-Kick (11-14)
1	Arcynopteryx
2	Rhithrogena
3	Baetis
4	Nemoura
5	Neureclipsis
	Siphlonurus
	Ephemerella
	Peltoperla
	Alloperla
	Limnephilidae
	Glossosomatidae

BLOCK 8, RUBY CREEK, STATION C

Rank	Pre-Spray Drift
1	Lepidostoma
2	Cinygmula
2	Chironomidae
3	Ephemerella
4	Baetis
4	Alloperla
5	Epeorus
5	Diptera (other)
	Rithrogena
	Plecoptera (other)
	Neureclipsis
	Diura
	Elmidae
	Paraleptophlebia
	Heleidae
	Mollusca
	TEREST.

Rank	Spray Drift
1	Alloperla
2	Cinygmula
3	Nemoura
4	Rithrogena
5	Chironomidae
6	Ephemerella
7	Baetis
8	Epeorus
9	Simuliidae
	Paraleptophlebia
	Lepidostoma
	Psychomiidae
	Amphizoa
	Tipulidae
	Diura
	Siphlonurus
	Glossosomatidae
	Limnephilidae
	Acroneuria
	Rhyacophilidae
	Nematoda
	TERREST.

(%)	Pre-Kick (7-9)
33	Rhitrogena
11	Ephemerella
44	Epeorus
11	Alloperla
	Total 9

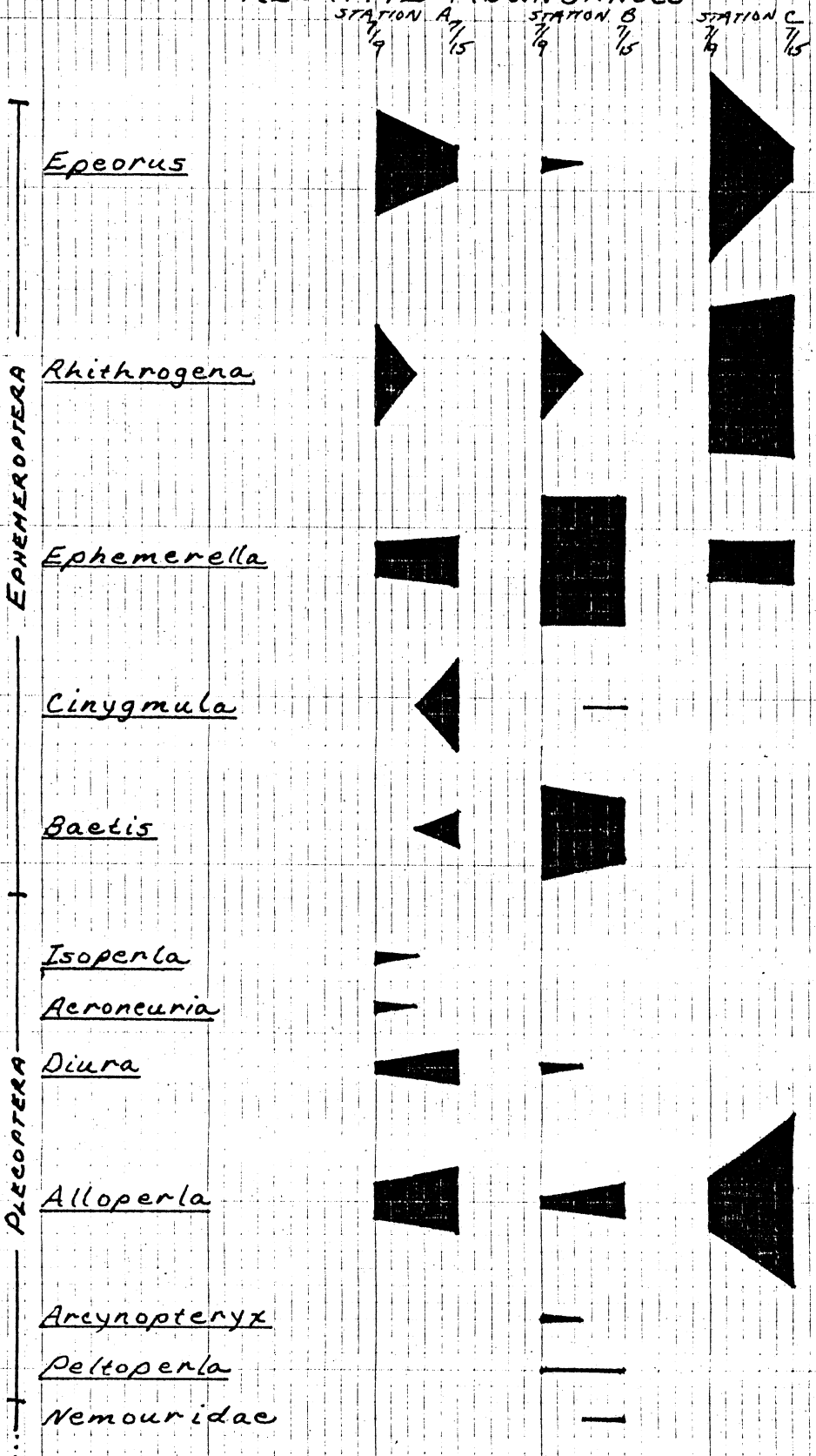
(%)	Post-Kick (9-15)
41	Alloperla
38	Rhithrogena
10	Ephemerella
7	Epeorus
3.5	Chironomidae
	TERREST.
	Total 29

Rank	Post-Kick (11-14)
1	Cinygmula
2	Nemoura
3	Ephemerella
4	Psychodidae
5	Trichoptera cases
	Baetis
	Acroneuria
	Isoperla
	Neureclipsis
	Glossosomatidae
	Arctopsyche
	Elmidae
	Simuliidae
	Tipulidae
	Chironomidae

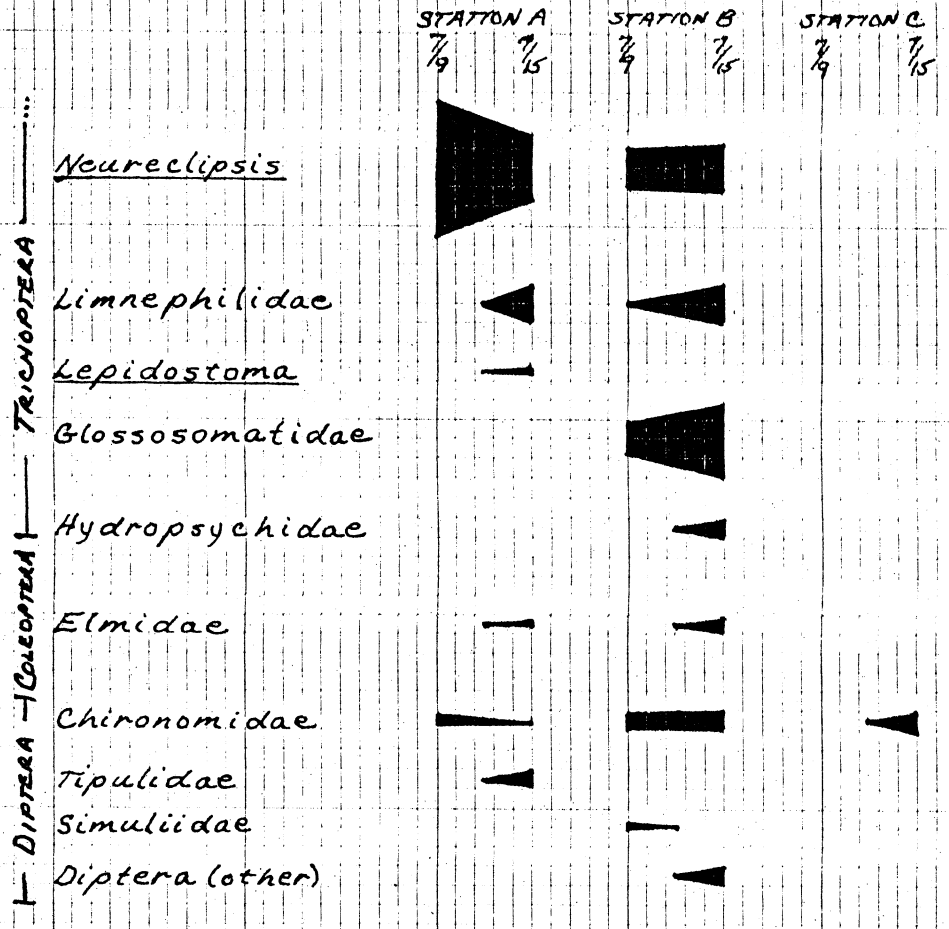
RUBY CREEK (STATIONS A, B, AND C) BLOCK 8

	Station A		Station B		Station C	
	7/9	7/15	7/9	7/15	7/9	7/15
Epeorus	23.5	7	3		44	7
Rhithrogena	23.5		20		33	38
Ephemerella	8	12	30	31	11	10
Cinygmula		22		1		
Baetis		7	20	14		
Isoperla	2					
Acroneuria	2					
Diura	2	7	2			
Alloperla	8	14.5	3	7	11	41
Arcynopteryx			1			
Peltoperla			1	1		
Nemouridae				1		
Neureclipsis	29	14.5	8	10.5		
Limnephilidae		7	1	7		
Lepidostoma		1				
Glossosomatidae			7	14		
Hydropsychidae				3		
Elmidae		1		3		
Chironomidae	2	1	3	3.5		3.5
Tipulidae		3				
Simuliidae			1			
Diptera (other)				3		
N	51	69	~300	143	9	29

Ruby Creek
Kick Samples
Relative Abundances



RUBY CREEK (CONT'D.)



BLOCK 6, MIDDLE FORK WARM SPRINGS CREEK

Rank	Pre-Spray Drift
1	Chironomidae
	Baetis
	Cinygmula
	Epeorus
	Stratiomyidae
	Tipulidae
	Corixidae

Rank	Spray Drift
1	Chironomidae
2	Baetis
3	Alloperla
4	Neureclipsis
5	Ephemerella
6	Nemoura
7	Siphlonurus
8	Diura
9	Cinygmula
10	Epeorus
10	Tipulidae
	Cinygmula
	Trichoptera case
	Lepidostoma
	Stratiomyidae
	Simuliidae
	TERREST.

Rank	Pre-Kick (7-9)
1	Ephemerella
2	Epeorus
3	Baetis
	Siphlonurus
	Diura
	Neureclipsis
	Parapsyche
	Chironomidae
	Tipulidae
	Hirudinea

(%)	Post-Kick (7-11)
57.5	Ephemerella
16	Neureclipsis
9	Chironomidae
6	Parapsyche
1	Nemoura
1	Diura
1	Brachycentrus
3.5	Stratiomyidae
1	Tipulidae
1	Mollusca
1	Hirudinea
	Total 87

(%)	Post-Kick (7-13)
73	Ephemerella
11	Neureclipsis
2	Parapsyche
2	Trichoptera case
2	Tipulidae
7	Chironomidae
4	Hirudinea
	TERREST
	Total 45

Post-Kick (10-30)
*Baetis
Limnephilidae
Psychodidae
Stratiomyidae
Chironomidae
Tipulidae
Hirudinea

* Not ranked because leaves prevented accurate estimate.

MIDDLE FORK WARM SPRINGS CREEK — BLOCK 6

Kick Samples	Relative Abundance (Percent Total Numbers, N)		
	7/9	7/11	7/13
Ephemerella	1*	57.5	73
Epeorus	2		
Baetis	3		
Siphlonurus			
Diura	+	1	
Nemoura		1	
Neureclipsis	+	16	11
Parapsyche	+	6	2
Brachycentrus		1	
Trichoptera (other)			2
Chironomidae	+	9	7
Tipulidae	+	1	2
Stratiomyidae		3.5	
Hirudinea	+	1	4
Mollusca		1	
N	?*	87	45

* Insects were not counted. Only rankings were noted.

+ Present in small quantities.

M.F. Wm. Springs Creek
Kick Samples
Relative Abundances

	7/9	7/11	7/13
Ephemeroptera			
Ephemerella	1*		
Epeorus	2		
Baetis	3		
Siphlonurus	+		
Plecoptera			
Diura	+		
Nemoura			
Trichoptera			
Neureclipsis	+		
Parapsyche	+		
Brachycentrus			
Trichoptera (other)			
Diptera			
Chironomidae	+		
Tipulidae			
Stratiomyidae			
Hirudinea	+		
Mollusca			

* Insects were not counted. Only rankings were noted.

BLOCK 4, WARM SPRINGS CREEK

Rank	Pre-Spray Drift
1	Chironomidae
2	Baetis
3	Simuliidae
4	Lepidostoma
5	Diptera (other)
	Epeorus
	Glossosomatidae
	Amphizoa
	Neureclipsis
	TERREST.

Rank	Spray Drift
1	Chironomidae
2	Baetis
3	Simuliidae
4	Diptera (other)
5	Alloperla
6	Elmidae
7	Lepidostoma
7	Limnephilidae
	Siphlonurus
	Cinygmula
	Diura
	Amphizoa
	Neureclipsis
	Tipulidae
	Ephemerella
	Nemoura
	Corixidae
	Psychodidae
	TERREST.

(%)	Pre-Kick (7-9)
48.5	Baetis
10	Epeorus
6.5	Ephemerella
6.5	Cinygmula
6.5	Diura
5	Neureclipsis
5	Siphlonurus
3	Chironomidae
3	Simuliidae
0.5	Acroneuria
0.5	Alloperla
0.5	Brachycentrus
1	Glossosomatidae
1	Lepidostoma
0.5	Limnephilidae
1	Elmidae
0.5	Tipulidae
	Total 309

(%)	Post-Kick (7-17)
37	Baetis
27	Chironomidae
20	Cinygmula
3	Epeorus
1	Ephemerella
3	Diura
1	Neureclipsis
1	Lepidostoma
1	Limnephilidae
1	Glossosomatidae
3	Tipulidae
1	Elmidae
1	Mollusca
	Total 149

Rank	Post-Kick (10-30)
1	Arcynopteryx
2	Baetis
3	Pteronarcys
4	Ephemerella
5	Nemoura
	Cinygmula
	Acroneuria
	Alloperla
	Arctopsyche
	Neureclipsis
	Lepidostoma
	Tipulidae
	Rhithrogena

WARM SPRINGS CREEK BLOCK 4

Kick Samples	Relative Abundance (Percent Total Numbers, N)	
	7/9	7/17
Baetis	48.5	37
Epeorus	10	3
Ephemerella	6.5	1
Cinygmula	6.5	20
Siphlonurus	5	
Diura	6.5	3
Acroneuria	0.5	
Alloperla	0.5	
Neureclipsis	5	1
Brachycentrus	0.5	
Glossosomatidae	1	1
Lepidostoma	1	1
Limnephilidae	0.5	1
Elmidae	1	1
Chironomidae	3	27
Simuliidae	3	
Tipulidae	0.5	3
Mollusca		1
N	309	149

WARM SPRINGS CREEK
KICK SAMPLES
RELATIVE ABUNDANCES

7/9 9/17

EPHEMEROPTERA

Baetis

Epeorus

Ephemerella

Cinygmula

Siphlonurus

PLECOPTERA

Diura

Acroneuria

Alloperla

TRICHOPTERA

Neureclipsis

Brachycentrus

Glossosomatidae

Lepidostoma

Limnephilidae

COLEOPTERA

Elmidae

DIPTERA

Chironomidae

Simuliidae

Tipulidae

Mollusca

BLOCK 7, SOUTH FORK WARM SPRINGS CREEK

Rank	Pre-Spray Drift
1	Lepidostoma
2	Simuliidae
3	Baetis
4	Chironomidae
5	Cinygmula
	Acroneuria
	Alloperla
	Neureclipsis
	Rhyacophilidae
	Brachycentrus
	Stratiomyidae
	Psychodidae
	Ephemerella
	TERREST.

Rank	Spray Drift
1	Simuliidae
2	Limnephilidae
3	Baetis
4	Stratiomyidae
4	Acroneuria
4	Chironomidae
5	Lepidostoma
6	Ephemerella
6	Brachycentrus
6	Diptera (other)
7	Neureclipsis
8	Epeorus
	Alloperla
	Amphizoa
	Tipulidae
	Cinygmula
	Siphlonurus
	Elmidae
	TERREST.

(%)	Pre-Kick (7-9)
34	Baetis
24	Cinygmula
6	Neureclipsis
6	Rhyacophilidae
5	Simuliidae
5	Ephemerella
5	Epeorus
4	Diura
3	Lepidostoma
3	Tipulidae
0.5	Elmidae
	Total 205

(%)	Post-Kick (7-18)
18	Epeorus
18	Baetis
15	Simuliidae
13	Cinygmula
11	Ephemerella
10	Neureclipsis
3.5	Lepidostoma
3	Brachycentrus
2	Rhithrogena
1	Acroneuria
1	Diura
1.5	Alloperla
1	Limnephilidae
1	Rhyacophilidae
0.5	Chironomidae
0.5	Tipulidae
	Total 197

Rank	Post-Kick (10-29)
1	Baetis
1	Psychodidae
2	Neureclipsis
3	Ephemerella
3	Rhithrogena
4	Brachycentrus
4	Elmidae
4	Chironomidae
5	Alloperla
6	Acroneuria
7	Nemoura
8	Tipulidae
	Lepidostoma
	Glossosomatidae

SOUTH FORK WARM SPRINGS CREEK BLOCK 7

Kick Samples	Relative Abundance (Percent Total Numbers, N)	
	7/9	7/18
Baetis	34	18
Cinygmula	24	13
Ephemerella	5	11
Epeorus	5	18
Rhithrogena		2
Diura	4	1
Acroneuria		1
Alloperla		1.5
Neureclipsis	6	10
Rhyacophilidae	6	1
Lepidostoma	3	3.5
Brachycentrus		3
Limnephilidae		1
Elmidae	0.5	
Simuliidae	5	15
Tipulidae	3	0.5
Chironomidae		0.5

S.F. Wm. Springs Creek
Kick Samples
Relative Abundances

EPHEMEROPTERA
- Baetis
- Cinygmula
- Ephemerella
- Epeorus
- Rhithrogena

TRICHOPTERA
- Diura
- Acroneuria
- Alloperla
- Neureclipsis
- Rhyacophilidae
- Lepidostoma
- Brachycentrus
- Limnephilidae

COLEOPTERA
- Elmidae

DIPTERA
- Simuliidae
- Tipulidae
- Chironomidae

BLOCK 7, SMITH CREEK, FRENCH CREEK, SQUAW CREEK

Smith Creek, Station 1

Rank	Pre-Spray Drift
1	Baetis
2	Cinygmula
	Ephemerella
	Siphlonurus
	Peltoperla
	Nemoura
	Elmidae
	Leptoceridae
	Chironomidae
	TERREST.

Rank	Spray Drift
1	Baetis
2	Trichoptera cases
3	Chironomidae
	Alloperla
	Peltoperla
	Nemoura
	Neureclipsis
	Simuliidae
	Tipulidae
	Ephemerella
	Rhithrogena
	Cinygmula
	Collembola
	TERREST.

(%)	Pre-Kick
24	Cinygmula
18.5	Baetis
13	Ephemerella
13	Rhithrogena
9	Neureclipsis
7	Acroneuria
4	Arcynopteryx
4	Nemoura
2	Epeorus
2	Tipulidae
4	Leptoceridae
	Total 54

French Creek, Station 2

Rank	Pre-Spray Drift
1	Baetis
2	Ephemerella
	Siphlonurus
	Paraleptophlebia
	Alloperla
	Rhyacophilidae
	Trichoptera case
	Chironomidae
	Simuliidae
	TERREST.

Rank	Spray Drift
1	Baetis
2	Limnephilidae
2	Chironomidae
3	Simuliidae
4	Peltoperla
4	Heptageniidae
	Ephemerella
	Cinygmula
	Alloperla
	Trichoptera cases
	Diptera (other)
	Arcynopteryx
	Neureclipsis
	Psychomiidae
	Tipulidae
	Siphlonurus
	Nemoura
	Rhyacophilidae
	TERREST.

(%)	Pre-Kick
34	Baetis
14	Cinygmula
15	Ephemerella
6	Neureclipsis
5	Rhyacophilidae
4	Rhithrogena
1	Epeorus
4	Peltoperla
1	Arcynopteryx
4	Alloperla
2	Acroneuria
7	Trichoptera cases
1	Tipulidae
2	Simuliidae
1	Chironomidae
	Total 104

Squaw Creek

(%)	Kick
37	Cinygmula
28	Baetis
12	Rhithrogena
6.5	Ephemerella
6	Limnephilidae
1	Arcynopteryx
2	Nemoura
2	Psychomiidae
3	Parapsyche
2	Simuliidae
1	Epeorus
	Total 107

Rankings were given only to taxa represented by at least five organisms in a given sample.